According to the present invention suitable matrix particles have an average particle size within a certain predetermined range. The average particle size is referred to herein as the log-normal distribution D_{50} median value. The D_{50} median value is determined by using the sieve analysis procedure described in the American Society for Testing and Materials (ASTM) standard B214-92, entitled "Standard Test Method for Sieve Analysis of Granular Metal Powders" and the reporting procedure described in ASTM D1366-86 (reproved 1991), entitled "Standard Practice for Reporting Particle Size Characteristics of Pigments". As used in this document, the matrix particles particle D_{50} median value is determined by plotting the cumulative weight percentages versus the upper class size limits data, as shown in ASTM D-1366-86, and then determining the diameter (i.e. D_{50}) that corresponds to the fifty percent cumulative weight value.

In a preferred embodiment the matrix particles have a particle size of about 5 to about 80 μm, preferably about 5 to about 50 μm, most preferably about 25 to about 40 μm. In order to prevent clogging of the pores, at least about 80 wt.-%, preferably about 85 wt.-%, most preferably about 98 wt.-% of the matrix particles have an average particle size which does not deviate more than about 15 %, preferably not more than about 10 %, most preferably not more than about 5 % from the average particle size.

Preferably the inorganic matrix particles are substantially free of dust having a particle size of less than about 5μm, preferably less than about 4μm. By "substantially free" there is meant that less than about 20 wt.-%, preferably less than about 15 wt.-% and most preferably less than about 10 wt.-% of the dust particles mentioned above are contained in the total of said matrix particles.

The inorganic matrix particles have a spherical shape, i.e., they are micro-spheres (micro-beads). A spherical shape leads to the least interaction (e.g., adhesion, friction, etc.) between the matrix particles and to the least clogging of the voids. The spherical shape of the matrix particles leads to flow-characteristics of the composition which is the basis for an excellent adaptation of fine surface structures of the master mold and renders the matrix particles

capable to image the surface to be transferred.

Various matrix materials which fulfil the prerequisites in regard of shape and average particle size can be used. The material of said matrix particles is selected from the group consisting of aluminium, copper, iron, steel, titanium, platinum, manganese, zinc, bronze and other metal alloys, coal, glass, ceramic, quartz, silica, silicon carbide, tungsten carbide, boron carbide, metakaolin, calcinated clay, chinese clay, calcium carbonate, barium sulfate, aluminium oxide, and magnesium oxide. Blends of particles of different material can be used.

By a suitable selection of the matrix material the properties such as thermal and electrical conductivity, fluid permeability and/or mechanical, thermal and chemical stability of the mold material can be controlled and predetermined.

The spherical matrix material is mixed with the binder polymer which sets after processing.

In a further aspect the present invention relates to a method of making a porous shaped article comprising the steps of

- mechanically mixing
  - (i) a minor amount of a binder, and
  - (ii) a major amount of spherical inorganic matrix particles ,
- forming the mixture into the desired shape,
- and exposing it for a time and at a temperature sufficient to solidify the mixture.

In particular, said method comprises the steps of

- mechanically mixing a major amount of spherical inorganic matrix particles with a minor amount of a binder selected from the group consisting of:
  - (a) particulate organic thermoplastic polymers,
  - (b) liquid organic polymer resins, and
  - (c) aqueous solutions of alkali silicates

- forming the mixture into the desired shape, and
- treating the mixture for a time and at a temperature sufficient to
  - in case of (a), sinter the polymer, or
  - in case of (b), cure the polymer, or
  - in case of (c), harden the mixture.

In case that a particulate thermoplastic organic polymer binder (a) is used the thermoplastic polymer binder and the spherical matrix material can be combined to form a premix with good shelf-life. Articles of various shapes, such as moldings, engraving or clamp tools can be formed from said premix. If a mold is to be formed from said premix the master mold is covered with the premix composition stamped, optionally followed by oscillating or vibrating the mixture. Subsequently the mold formed is sintered by a heat and pressure treatment and, thereafter, separated from the master mold. Concerning the particle size of the particulate thermoplastic organic binder polymer (a), the binder particles must have a particle size which is smaller or at least equal to the particle size of the spherical matrix particles.

In conjunction with the present invention the term "sintering" describes a controlled heat and pressure treatment by which the spherical matrix particles are covered with a thin layer of the molten binder polymer bonding the spherical particles together and maintaining the final shape of the shaped article.

Dependent on the nature of the polymer binder the heat treatment takes between about 0.5h and about 30h, preferably between about 0.5h and about 25h.

The processing temperatures have to be above the melting point of the thermoplastic polymer. In general the processing temperature is between about 100°C and about 400°C, preferably between about 100°C and about 250°C.

The applied processing pressure depends on the shape and structure of the